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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/837,007	04/18/2001	Mou-Shiung Lin	MEG 01-004	7677

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SAILE ACKERMAN LLC
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EXAMINER

ZARNEKE, DAVID A

ART UNIT	PAPER NUMBER
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2891

MAIL DATE	DELIVERY MODE
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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

09/837,007

Applicant(s)

LIN ET AL.

Examiner

David A. Zarneke

Art Unit

2891

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 December 2007 & 02 November 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 55 and 57-65 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 55 and 57-65 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/2/07 has been entered.

Response to Arguments

Applicant's arguments with respect to the rejections of the claims have been fully considered and are persuasive. Therefore, these rejections have been withdrawn. However, upon further consideration, new grounds of rejection are made below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 55, 57-63 and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozawa, US Patent 6,181,010.

Nozawa (figures 2 & 9) teaches a chip package; comprising:

a semiconductor device [100];

a substrate [1000] comprising a solder mask [106] and a first pad [104] separate from with a sidewall not covered by a said solder mask, wherein said first pad is at a horizontal level same as said solder mask is at;

a metal pillar [22] between said semiconductor device and said first pad, substrate, wherein said metal pillar has a thickness between 10 and 100 micrometers (4, 50-57);

an under bump metal layer [124] between said metal pillar and said first pad, wherein said metal pillar has a transverse dimension smaller than that of said under bump metal layer, wherein said metal pillar has a first sidewall recessed from a second sidewall of said under bump metal layer, and wherein said under bump metal layer comprises a first portion over said metal pillar and a second portion overhanging said metal pillar (figure 2); and

a solder metal [200] between said under bump metal layer and said first pad, substrate, wherein said solder metal is bonded to said first pad.

Nozawa fails to teach said first pad has a circular shape.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a circular first pad in the invention of Nozawa because the shape of the pad is an obvious matter of aesthetic design choice. Design choices and changes of size are generally recognized as being within the level of ordinary skill in the art (MPEP 2144.04(I), (IVA) & (IVB)).

Nozawa also fails to teach a distance between said first sidewall and said second sidewall is greater than 0.2 micrometers.

It would have been obvious to one ordinary skill in the art at the time of the invention to optimize the distance to be greater than 0.2 micrometers through routine experimentation (MPEP 2144.05).

Nozawa further fails to teach an underfill between said semiconductor device and said substrate, wherein said underfill contacts with said semiconductor device and said substrate and encloses said metal pillar and said solder metal.

It would have been obvious to one ordinary skill in the art at the time of the invention to use an underfill between said semiconductor device and said substrate because underfills are commonly known used by skilled artisans to protect and strengthen the package. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Regarding claims 57 and 62, Nozawa teaches said substrate further comprises multiple second pads (figure 9 shows multiple pads) at said horizontal level, wherein each of said multiple second pads has said circle shape, wherein said solder mask is separate from said multiple second pads, and wherein said first pad and said multiple second pads are aligned in a direction parallel with a sidewall of said solder mask, wherein the distance between a sidewall of said metal layer and a sidewall of said metal pillar is greater than 0.2 microns (see above for rejection of circular pads and distance greater than 0.2 microns).

With respect to claim 58, Nozawa teaches said semiconductor device comprises a second pad and a passivation layer, wherein said second pad is exposed by an opening in said passivation layer, and wherein said metal pillar is between said second pad and said first pad substrate (figures 2 & 9).

As to claim 59, while Nozawa fails to teach a barrier layer between said metal pillar and said second pad, a barrier layer is commonly known used by skilled artisans to strengthen the bond between the pad and the pillar. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

In re claim 60, while Nozawa, which teaches a circuit board (PCB) (8, 30+), fails to teach said substrate comprises a ball grid array substrate, it would have been obvious to one of ordinary skill in the art at the time of the invention to substitute a BGA for a PCB in the invention of Nozawa because BGAs and PCBs are known equivalent substrates to which semiconductor devices are attached. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly

suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Regarding claim 61, while Nozawa fails to teach a contact ball under said substrate, wherein said semiconductor device is over said substrate, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a contact ball under said substrate in the invention of Nozawa because a contact ball is conventionally used in order to attach the package to the next level of integration. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

With respect to claim 63, Nozawa teaches said substrate, comprises multiple second pads at said horizontal level, wherein said solder mask is separate from said multiple second pads, but fails to teach wherein each of said multiple second pads has said circular shape, and wherein said first pad and said multiple second pads are aligned in a line further comprising a molding compound between said semiconductor device and said substrate.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a circular pad in the invention of Nozawa because the shape of the pad is an obvious matter of aesthetic design choice. Design choices and changes of size are generally recognized as being within the level of ordinary skill in the art (MPEP 2144.04(I), (IVA) & (IVB)).

Further, it would have been obvious to one of ordinary skill in the art at the time of the invention to align the pads in a line and use a molding compound because both are conventionally known to skilled artisans. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

As to claim 65, Nozawa teaches said substrate further comprises a second pad at said horizontal level, wherein said second pad is separate from said solder mask (figure 9), but fails to teach wherein said second pad is the pad closest to said first pad and has said circular shape, and wherein said first pad has a diameter greater than the minimum distance between said first and second pads first region is substantially coplanar with said second region.

In re the circular pad, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a circular pad in the invention of Nozawa because the shape of the pad is an obvious matter of aesthetic design choice. Design choices and changes of size are generally recognized as being within the level of ordinary skill in the art (MPEP 2144.04(I), (IVA) & (IVB)).

With respect to the first pad has a diameter greater than the minimum distance between said first and second pads first region is substantially coplanar with said second region, It would have been obvious to one ordinary skill in the art at the time of the invention to optimize the relative pad size through routine experimentation (MPEP 2144.05).

Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozawa, US Patent 6,181,010, as applied to claim 55 above, and further in view of Yoneda et al., US Patent 6,229,711.

Nozawa teaches said substrate further comprises a second pad at said horizontal level, wherein said second pad is separate from said solder mask (figure 9), but fails to teach wherein said second pad is the pad closest to said first pad and has said circular shape, neighboring to said first pad and having an edge not covered by a solder mask, and wherein no solder mask traverses between said first and second pads.

Regarding the circular pad, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a circular first pad in the invention of Nozawa because the shape of the pad is an obvious matter of aesthetic design choice. Design choices and changes of size are generally recognized as being within the level of ordinary skill in the art (MPEP 2144.04(I), (IVA) & (IVB)).

As to the neighboring to said first pad and having an edge not covered by a solder mask, and wherein no solder mask traverses between said first and second pads.

Yoneda teaches said substrate further comprises a second pad neighboring to said first pad and having an edge not covered by a solder mask, and wherein no solder mask traverses between said first and second pads (figure 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the first pad with a sidewall not covered by a solder mask of Yoneda in

the invention of Ohuchi because Yoneda teaches the insulating layer [sic:solder layer] from spreading (3, 51+) and protects the remaining parts, (5, 7+).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The prior art cited but not relied upon teaches the state of the art.

Any inquiry concerning this communication from the examiner should be directed to David A. Zarneke at (571)-272-1937. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Baumeister can be reached on (571)-272-1722. The fax number where this application is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David A. Zarneke/
Primary Examiner
1/17/08